Abstract

The present invention relates to a projection exposure apparatus (10) for and method of imaging a reticle (R) having patterned surface onto a substrate (W) in photolithographic processes for manufacturing a variety of devices. The invention further relates to an optical system (C) having a folding member (M1) suited to the projection exposure apparatus, and a method for manufacturing the optical system. The projection exposure apparatus comprises an illumination optical system (IS) and a reticle stage (RS) capable of holding the reticle so the normal line to its patterned surface is in the direction of gravity. The apparatus also includes a substrate stage (WS) capable of holding the substrate with its surface normal parallel to the direction of gravity. The optical system includes a first imaging optical system (A) comprising a concave reflecting mirror and a dioptric optical member arranged along a first optical axis. The first imaging optical system (A) forms an intermediate image of the patterned surface. The optical system also includes a second imaging optical system (B) having a second optical axis, and forms a reduced image of the intermediate image on the substrate. The first folding member is arranged in the optical path from the first imaging optical system to the second imaging optical system. The first and second imaging optical systems and the first and second folding members are positioned so that a reduced image of the pattered surface is formed parallel to the pattern surface of the reticle, and the first and second optical axes are positioned so that they are substantially parallel to the direction of gravity.

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